

Reference Aid
Rocky Mtn. Forest & Range Expt. Station
1,443,624

THE JORNADA EXPERIMENTAL RANGE



Range Research Leads The Way To
Better Management, Better Forage,
Better Cattle and Better Income.

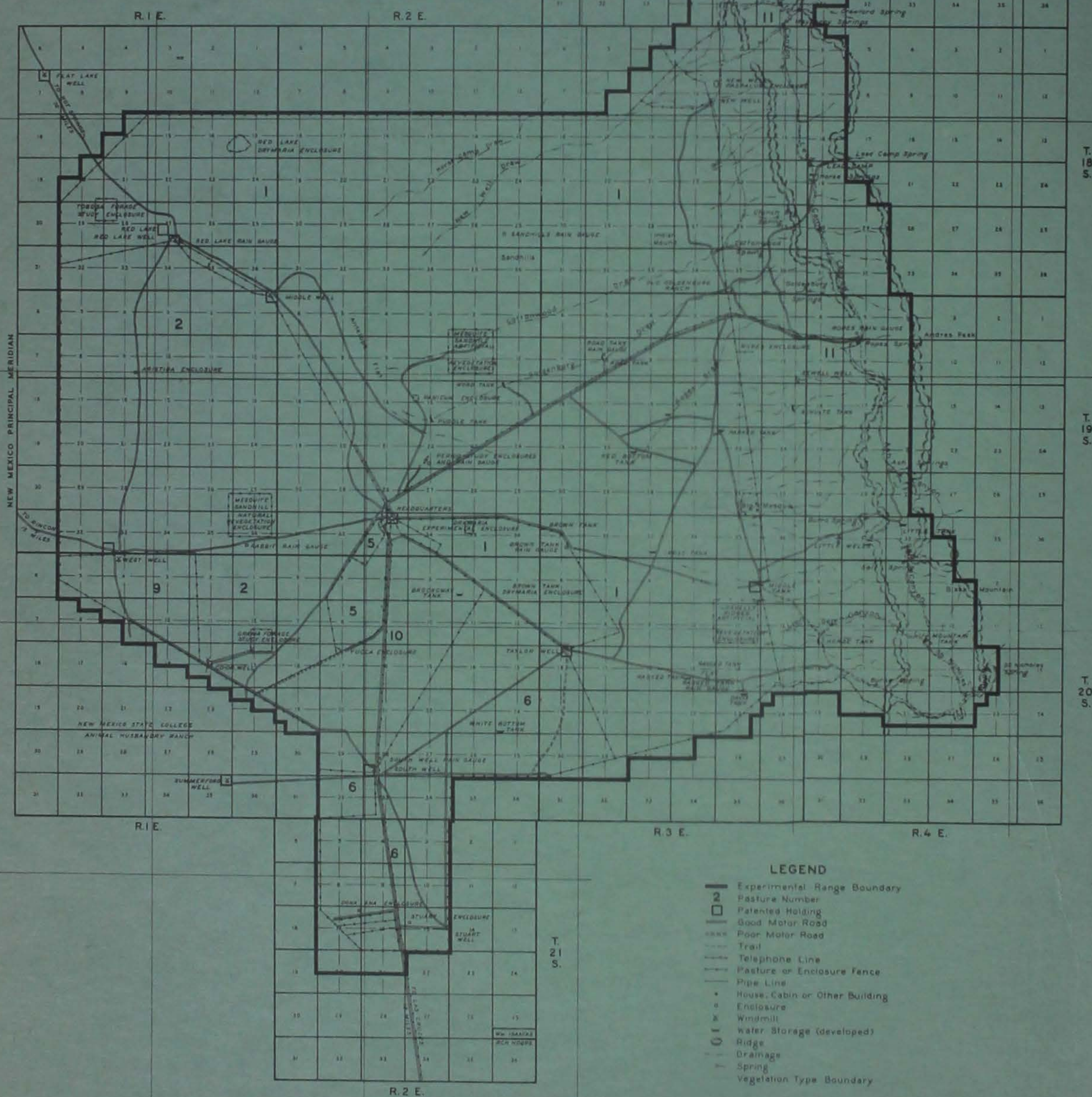
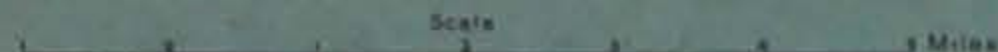
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SOUTHWESTERN FOREST AND RANGE EXPERIMENT STATION
TUCSON, ARIZONA

DONA ANA COUNTY
NEW MEXICO
1936

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

1936

Scale 0 1 2 3 Miles



THE JORNADA EXPERIMENTAL RANGE

The Jornada Experimental Range established by executive order in 1912 is one of the oldest areas in the United States set aside for the solution of problems confronting range stockmen. First operated by the Bureau of Plant Industry, it has been under the jurisdiction of the Forest Service since 1915. With the development of a National program for forest and range research in 1930, the Jornada was made a unit of the Southwestern Forest and Range Experiment Station, headquarters offices of which are maintained at Tucson, Arizona.

The range covers 193,394 acres on the Jornada Del Muerto Plain in Dona Ana County, New Mexico. Headquarters are located 23 miles north of Las Cruces. The elevation ranges from 3900 feet to over 8000 feet at the summit of the San Andres Mountains.

The vegetation of the Jornada is classified as semidesert grassland. This important southwestern range forage type covers some 60 million acres in Arizona, New Mexico, and West Texas (Fig. 1). No less than 26 million acres are so similar to the Jornada in vegetation, soils and climate that the results of studies there can be applied directly. On this portion valuable grazing is provided by black grama grasslands on the well drained uplands and by tobosa grass flats. The less valuable mesquite sandhill and creosote-tarbrush types occupy extensive areas. Soils are generally light sandy loams often underlain at shallow depths with caliche. The dry lake beds and tobosa flats have heavy impervious clay soils.

The climate is arid. Annual precipitation on the Jornada averages about 9 inches, with more than half coming during the summer months of July, August, and September. Solar radiation, wind movement, and evaporation are intense. More than 100 inches is evaporated from a free water surface each year. Precipitation varies greatly from year to year and drought is a normal part of the climate. During the driest year of the Jornada record only 3.62 inches fell, compared with 17.74 inches in the wettest year. Three or four consecutive years in every 8 to 10 year period are so dry as to be considered droughts by stockmen.

The broad objectives of the Jornada research program have been formulated to provide information needed by stockmen and others concerned with range management to maintain and improve ranges for future generations and to realize maximum economical beef production each year. This involves studies of grazing capacity and methods of grazing management that will take into account the growth requirements of range forage plants as well as the needs of the cattle, how to minimize the effect of drought, increase calf crops and lower death losses, artificial aids to range betterment through reseeding and control of undesirable plants and finally economic aspects of range cattle production. The Jornada is admirably suited to the gathering of such information. Many of the principles of range management discovered there, including methods of

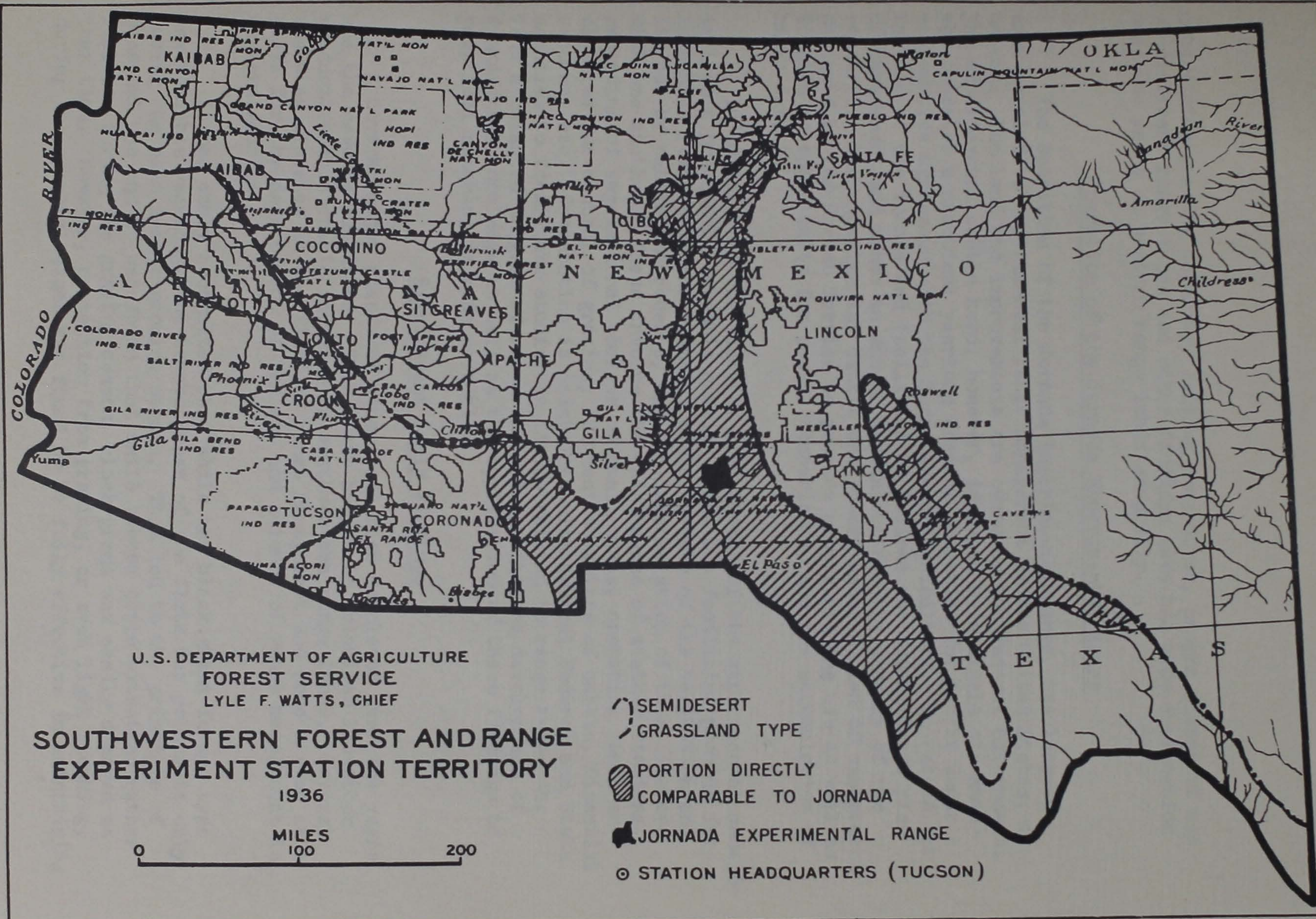


Figure 1.

determining grazing capacity, salting procedures, proper season of use of different range types and other findings have had wide application over the years on western range lands generally.

Operation of the Jornada Experimental Range

The operation of the Jornada Experimental Range, the largest area devoted to experimental range management in the United States, is unique. The land and improvements are owned by the Federal Government. The experimental cattle herd, however, is owned by a single stockman who operates a practical yearlong grazing operation for profit under a cooperative agreement with the Secretary of Agriculture. In return for the use of the forage and facilities he follows the experimental plan of management and makes an annual payment toward the conduct of the research. The experimental cattle are grazed under a plan of management designed by the Forest Service to provide proper grazing use as well as to give an opportunity for tests, comparisons, and the accumulation of basic data.

In addition to the study of the effects of the experimental management on a practical, economic grazing unit, the facilities provide for intensive studies of the climate, soils, growth of the vegetation and its use by cattle and rodents, and the interrelation of these factors with one another. These involve the maintenance of weather stations, recording of vegetational changes on small plots, operating panel enclosures for control of grazing, frequent weighings of cattle, financial records, etc. Cooperation is maintained with several Federal and State agencies to facilitate studies in fields related to range research. Thus a balanced program of research that permits the development of fundamental knowledge as well as the application of these findings to practical ranching is made possible.

Significant Early Findings

Several major phases of study have been completed over the years and the results published. These have helped to establish livestock production as a stable industry on southwestern range lands. Several stand as classics in the field of range management and have served as a basis for the development of the art and science of range management in western America.

It was early recognized that while the black grama forage type was valuable yearlong, the tobosa grass of the flats was palatable only during the main summer growing season. This led to the principle of seasonal use and it was found that while tobosa could withstand rather full use during the grazing season, black grama was easily damaged at that time. However, protection from grazing, or even light stocking, during the growing season was found to be fully effective in maintaining

or increasing the valuable black grama. The importance of well distributed watering places to favor uniform distribution of grazing and keep cattle in good condition so that they produced satisfactory calf crops each year was also clearly evident in the early years. 1/

The dry years of 1916 to 1918 brought the realization that periodic drought is normal in the Southwest and plans should be made to meet it. On ungrazed range, the better forage grasses declined more than 40 percent between 1916 and 1919. While the loss was increased by heavy grazing, it was not affected by moderate use, thus reaffirming the conviction that continued livestock production was possible under these severe conditions, but also pointing to the need for reduced stocking during and following drought. The need for better distribution of cattle by water development, salting, and riding, and for improvement in grade was brought out. The possibility for increasing calf crops by 30 or more calves per hundred cows by keeping cows in good condition and proper handling of bulls was also seen. 2/

A stocking policy based on the inevitable recurrence of drought began to take shape in 1924 when it was first suggested that the breeding herd be kept down at all times to the grazing capacity in the average forage crop years. Any additional forage in average or better years could be utilized by hold-over steers or heifers. Early weaning of calves to save forage and condition the cows for breeding was also recommended, as were various sources of supplemental feed for use in drought years. 3/

Detailed studies provided some information concerning the growth and best use of black grama, the most valuable grass on many semidesert ranges. Records showed that this grass can be kept productive in good and poor years alike by conservative grazing with protection during growth season. Standards of proper degree of use, that permitted the taking of 40 to 50 percent of the plant (by weight), and that would maintain its vigor and could be easily recognized by stockmen were set up as a result of these early studies. 4/ 5/ 6/

1/Jardine, J. T., and Hurtt, L. C.: Increased cattle production on southwestern ranges. U.S.D.A. Bul. 588, 32 pp., illus. 1917.

2/_____, and Forsling, C.L.: Range and cattle management during drought. U.S.D.A. Bul. 1031, 84 pp., illus, May 15, 1922.

3/Forsling, C.L.: Saving livestock from starvation on southwestern ranges. U.S.D.A. Farmers' Bul. 1428, 22 pp., illus. 1924.

4/Nelson, Enoch W.: The influence of precipitation and grazing upon black grama grass range. U.S.D.A. Tech.Bul. 409, 32 pp., illus, April 1934.

5/Campbell, R.S., and Crafts, Edw. C.: How to keep and increase black grama on southwestern ranges. U.S.D.A. Leaflet 180, 8 pp. illus, 1939.

6/Canfield, R. M.: The effect of intensity and frequency of clipping on density and yield of black grama and tobosa grass. U.S.D.A. Tech. Bul. 681, 32 pp., illus. 1939.

An example of the wide application of information developed by research is in the use of vegetational composition, plant vigor, utilization of forage, soil stability, and similar guides as indicators of the productive condition of ranges. The concept of range condition or "state of health" and condition indicators is now an accepted part of good range management by all who are concerned with administration of rangelands throughout the West. 7/

Other early contributions relate to determining how low value snake-weed can be controlled by grazing management, recommending good salting practices, exploring the possibilities of artificial revegetation to improve semidesert ranges, and developing methods for study of range vegetation and problems.

Recent Findings

Operation of the Jornada has been on a restricted basis since the early years of World War II. Limited funds, wartime restrictions, and devaluation of the research dollar have combined to make it possible only to maintain the plant and continue minimum long time records. During this period, however, some important new findings have been made, earlier leads have been confirmed and amplified, and quantitative relationships have been more firmly established.

Flexible Stocking Policy Provides The Best Drought Insurance

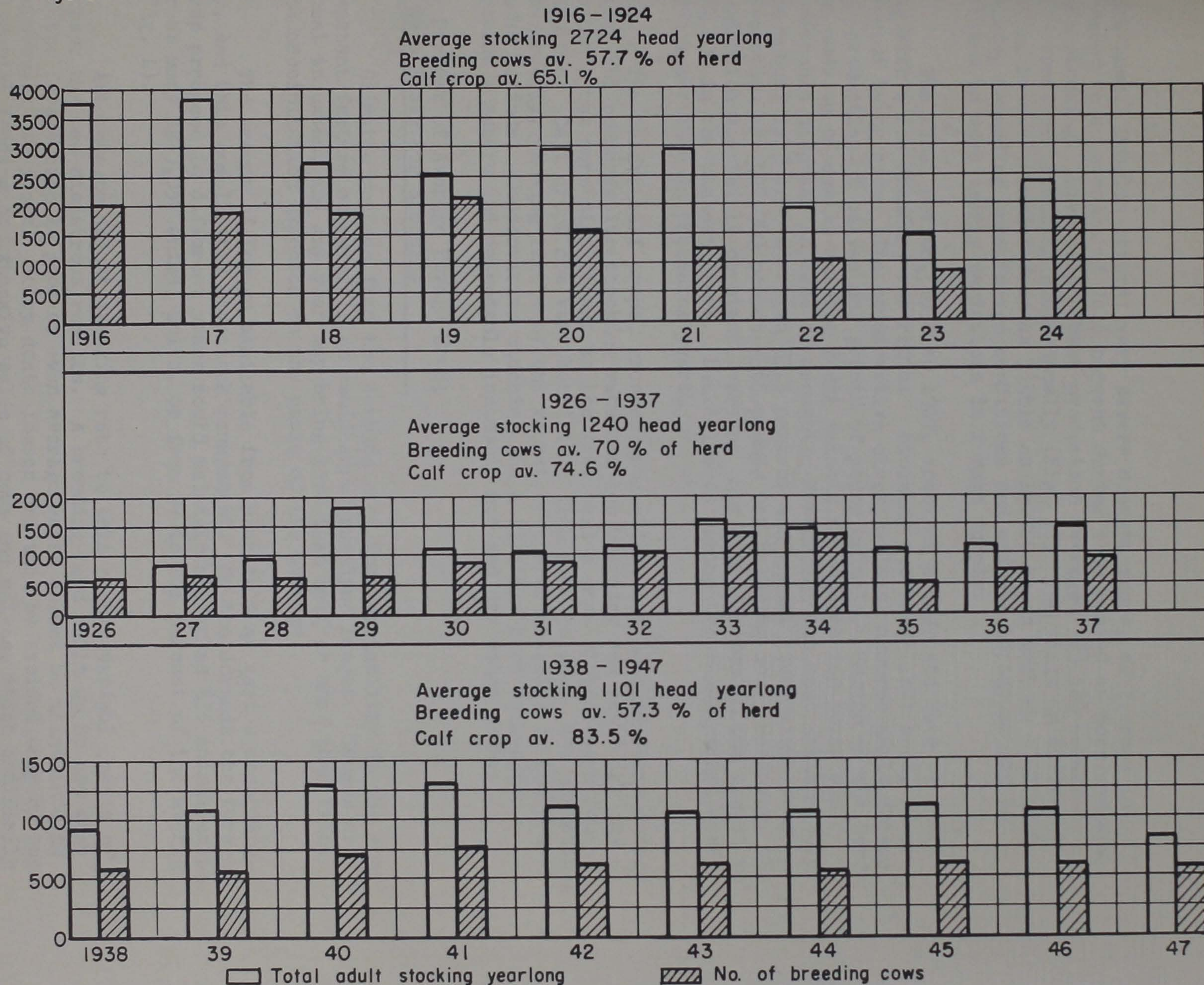
Analysis of stocking records and management systems employed since the initiation of studies on the Jornada has made possible comparisons of livestock production records between three periods, each with a characteristic system of stocking (Fig. 2).

From 1916 to 1924, inclusive, stocking was heavy according to present standards, with a rather low ratio of breeding cows to total numbers in the herd. The average stocking was 2,724 head. Cows made up 57.7 percent, the balance being composed of bulls, replacements for the breeding herd, and growing steers and heifers. During this period annual calf crop averaged 65.1 percent. Although considerably better than that being obtained on many comparable outside ranges, this was still less than satisfactory.

In the second period, 1925 to 1937, stocking was reduced more than 50 percent but a higher proportion of the total herd was made up of breeding cows. Of the total average annual stocking of 1,240 head, 70 percent

7/Talbot, M. W.: Indicators of southwestern range conditions. U.S. Dept. Agr. Farmers' Bul. 1782, 34 pp., illus. 1937.

Figure 2. TOTAL ADULT STOCKING AND NUMBER OF BREEDING COWS FOR THREE PERIODS 1916-47



were cows. Despite several very severe drought years, calf crops increased to an average of 74.6 percent during this period of more conservative stocking. Live weight beef production averaged 393,520 pounds—317 pounds per breeding cow—annually (Fig. 3). The yield in different years, however, varied from as little as 16,700 to as much as 1,000,800 pounds, depending upon forage conditions and efforts to adjust cattle numbers to meet yearly variations in forage supply.

The final period, 1938 to 1947, combined a moderate rate of stocking with a low breeding cow ratio. Stocking averaged 1,101 head, 57.3 percent being cows. The conservative stocking level assured ample forage for production of calves and growth of young animals. Enough of the herd was made up of easily salable young animals to provide for quick and profitable disposal in case of drought. Production was most satisfactory. The annual calf crop averaged 83.5 percent and annual live weight beef production was 401,700 pounds—365 pounds per breeding cow. Moreover, the production was fairly constant, varying only from 301,000 in the lowest to 544,200 in the highest years. Death losses during the final period were also lower than in preceding years.

The larger calf crops, greater production, and lowered death losses under the conservative stocking rate and low breeding cow ratio are important, but more significant is the fact that a more stable operation resulted. Calf crops now vary but little from year to year, and marketings are orderly, showing little of the variation characteristics of the previous periods. Conservative stocking and a flexible herd makeup can provide a secure and dependable income in wet and dry years alike.

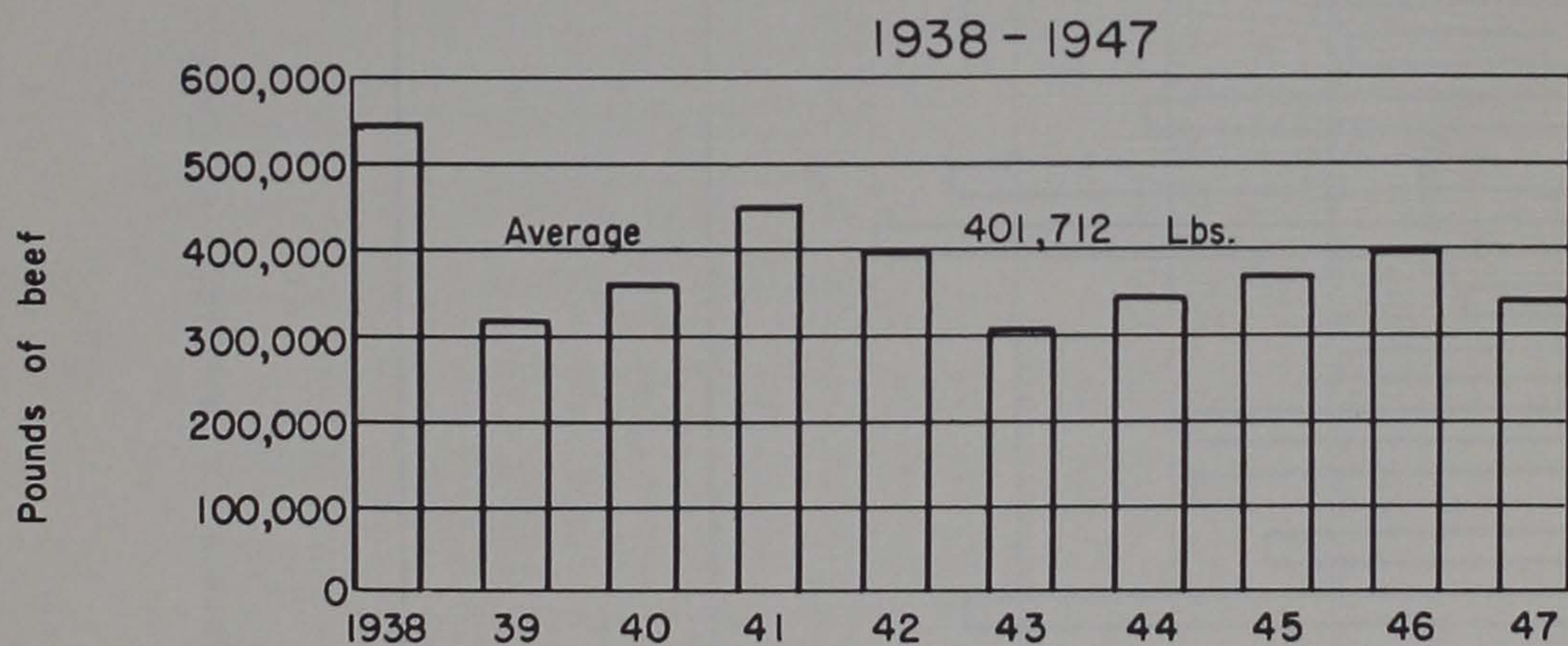
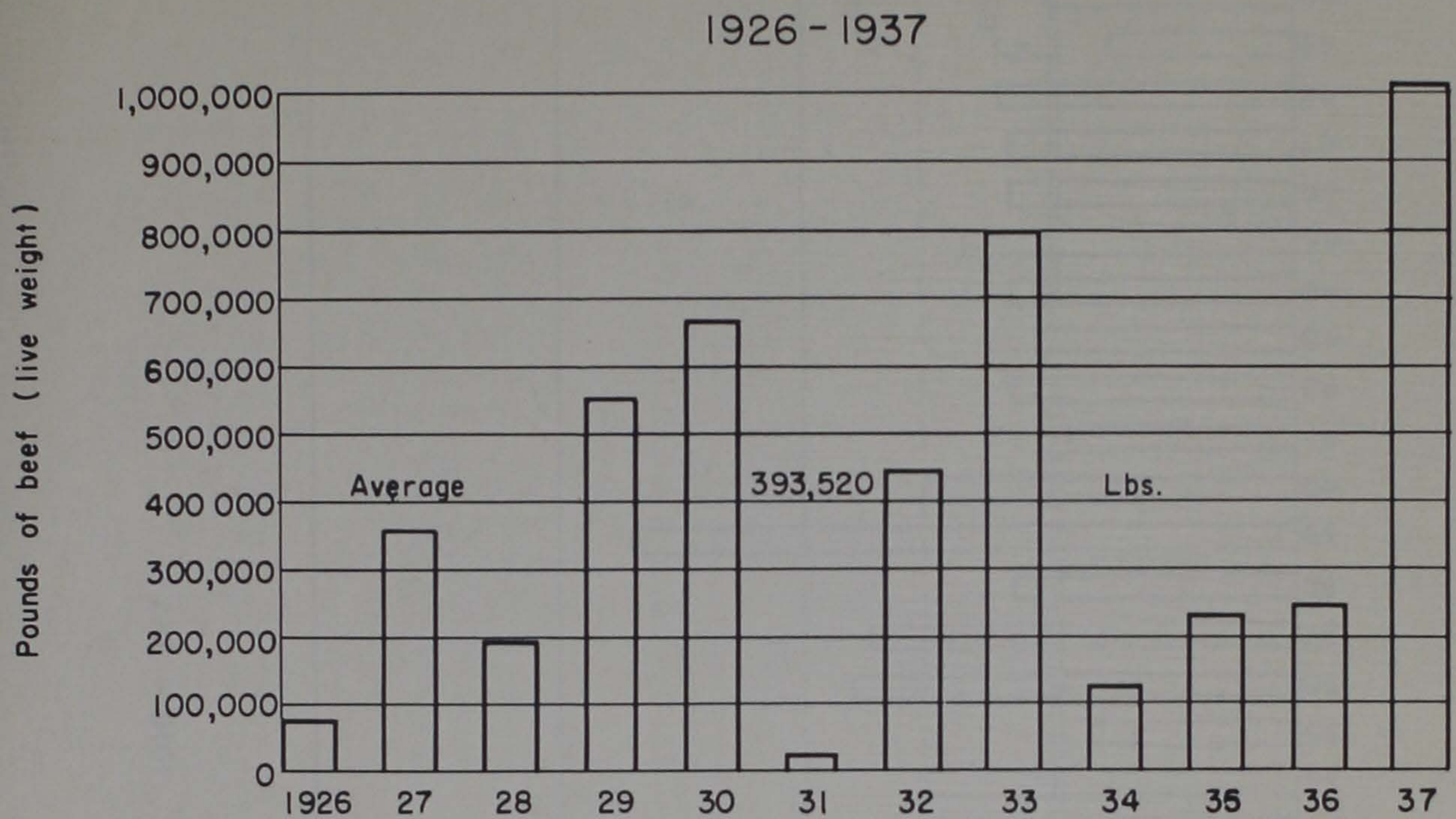
65 Percent of Average Forage Crop; A Safe Basis For Stocking

Climatic records from the Jornada show that variability is the most constant feature of rainfall on semidesert grassland ranges. Storms are local in extent and any year may bring less than half or more than twice the precipitation expected on the basis of the average.

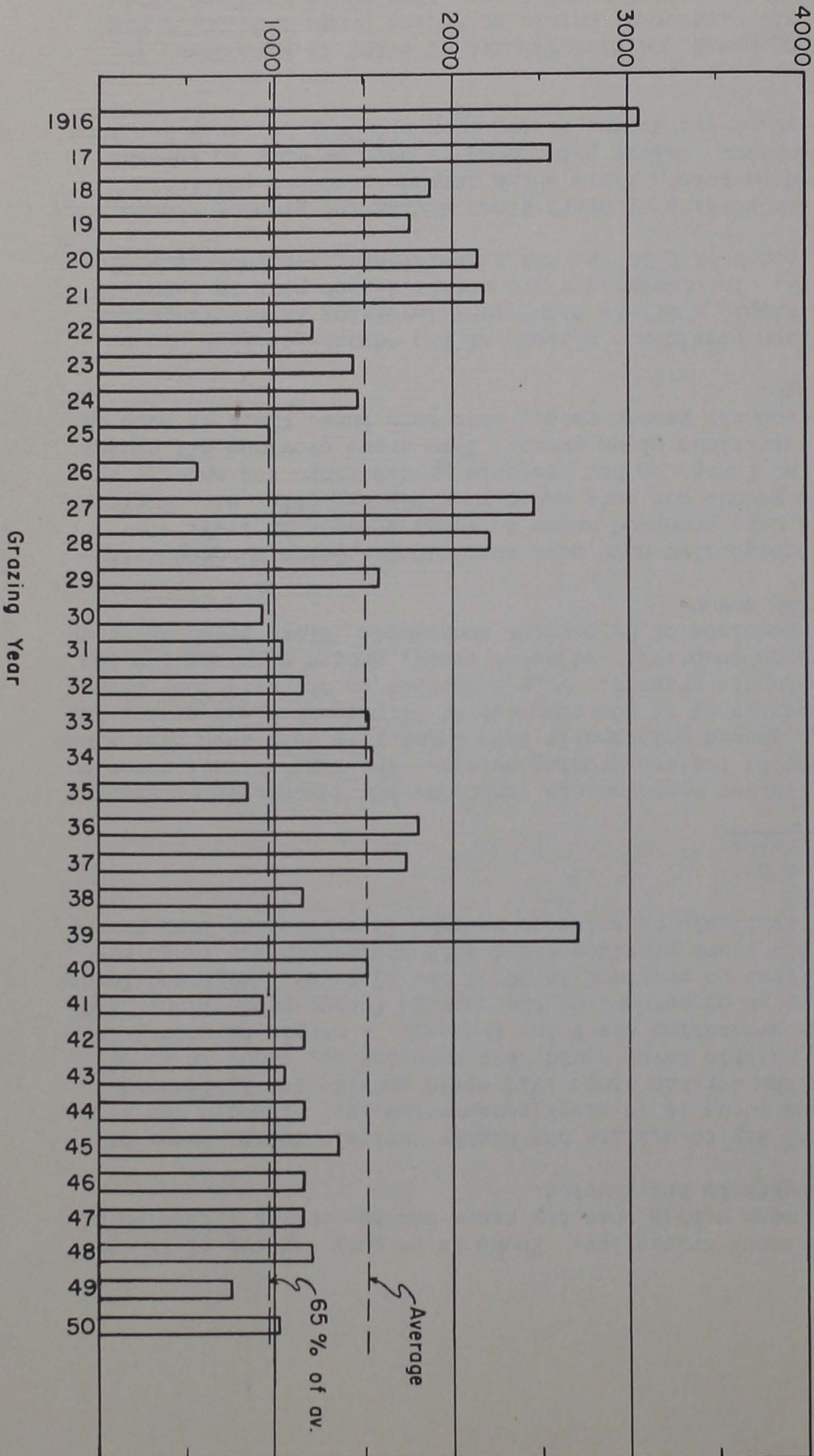
The amount of forage available from year to year varies accordingly, and this complicates livestock management. On the Jornada the forage crop produced in different years could maintain as few as 556 animal units to as many as 3,057 animal units, or from 37 to 201 percent of the average (Fig. 4).

Attempts to adjust stocking rate to this highly variable basis of forage has had disastrous results. A breeding herd built up to use most of the forage crop in good or even average years cannot be maintained in subsequent dry years. Heavy death losses can then be avoided only by supplemental feeding or extensive sales of cows and calves, which ordinarily do not find a ready market. In times of drought, feed prices are usually

Figure 3. ANNUAL BEEF MARKETED IN LBS. FOR TWO PERIODS,



Forage crop expressed in animal units, yearlong.



high and range livestock prices low. There is no easy way out of the predicament of having more cattle than the range can support at a time when feed is scarce and markets are glutted.

The practical way to utilize the highly variable forage crops of semidesert grassland areas is to stock conservatively. Although the average forage crop on the Jornada since 1916 would provide for 1,518 head yearlong, stocking at this level would have been unwise, since in 20 of the 35 years forage production was below average. A margin of safety is provided by stocking at 65 percent of the average forage production. Adequate forage would thus be provided in 30 of the 35 years. Ungrazed forage produced in favorable years provides added soil protection for range rehabilitation or is available as a forage reserve in subsequent lean years.

More Forage Produced By Grazing at Proper Season

Recent qualitative measurements emphasize the advantages of grazing black grama only during the non-growing season. The vegetational cover on a black grama range grazed principally from October to July each year since the Jornada was established is now composed of 72 percent black grama, and 20 percent other valuable grasses. Only 8 percent is the worthless snake-weed (Fig. 5). A once comparable adjacent range, grazed yearlong for the past 20 years, now consists of 69 percent snakeweed. Black grama makes up only 9 percent of the cover.

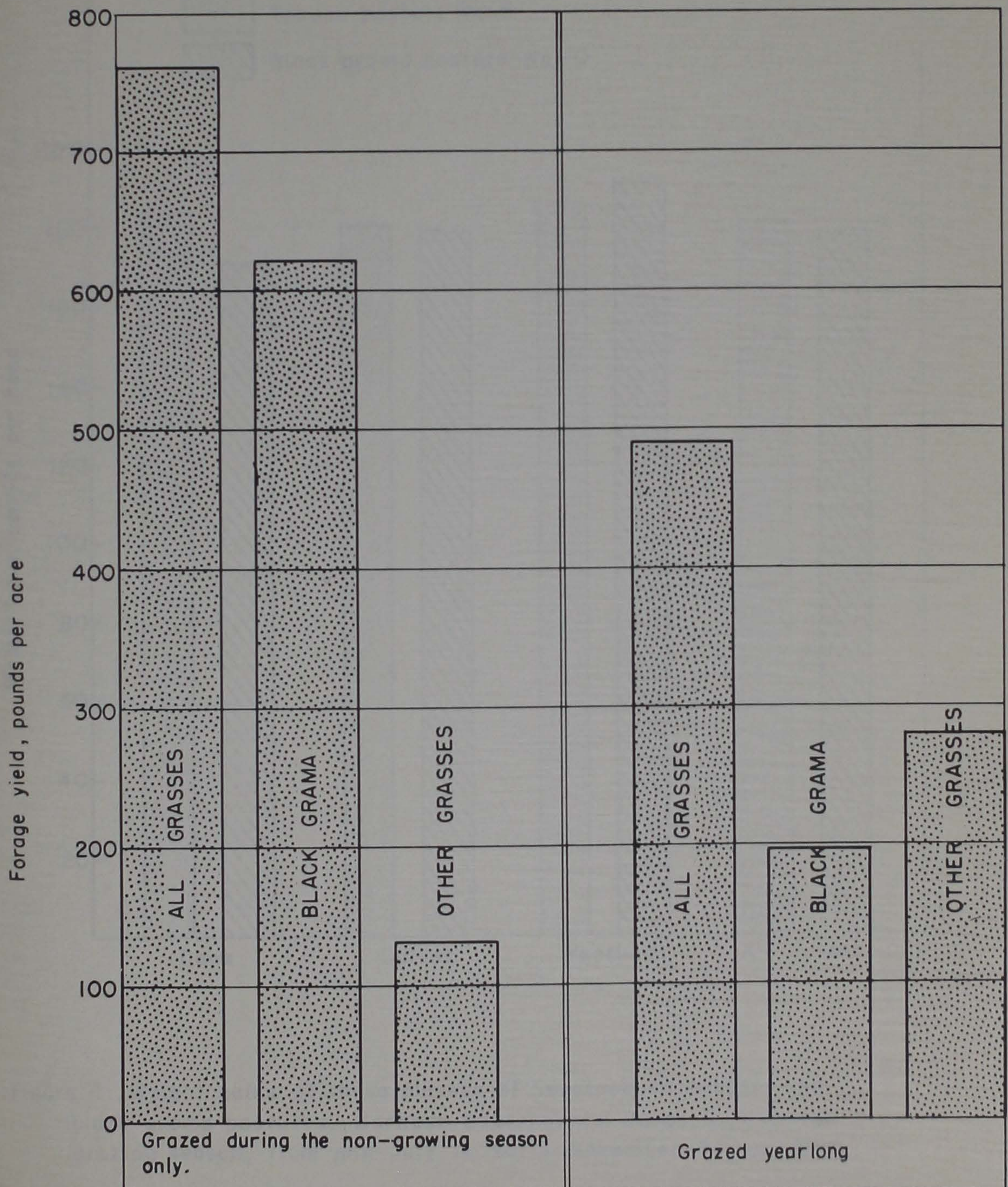
Yields of herbage also have been maintained. Seven hundred fifty-two pounds per acre were produced under seasonal grazing in 1947, compared with only 481 pounds per acre under yearlong use (Fig. 6). Furthermore, the bulk of the forage on the properly grazed range was made up by the palatable and nutritious black grama. This grass provided 621 pounds per acre on the seasonally grazed range, more than three times as much as on the yearlong range.

This comparison provides a measure of the advantages that can be realized by only a simple shift in management involving little financial outlay or extra work. The advantages are realized each year in terms of production of more and better forage and a profitable livestock operation.

To provide for resting of black grama during the growing season, cattle can be grazed on tobosa flats which provide abundant palatable forage during the summer. Cattle gain about as much or more on tobosa as on black grama during the summer season from mid-July to early November (Fig. 7).

In 1949, when amount and distribution of rainfall were about the same in each type, all classes of cattle on tobosa range made an average summer-gain of 17 pounds or 11.3 percent more than those on black grama

Figure 6. Forage yields of black grama range
grazed yearlong and during the non-growing season only



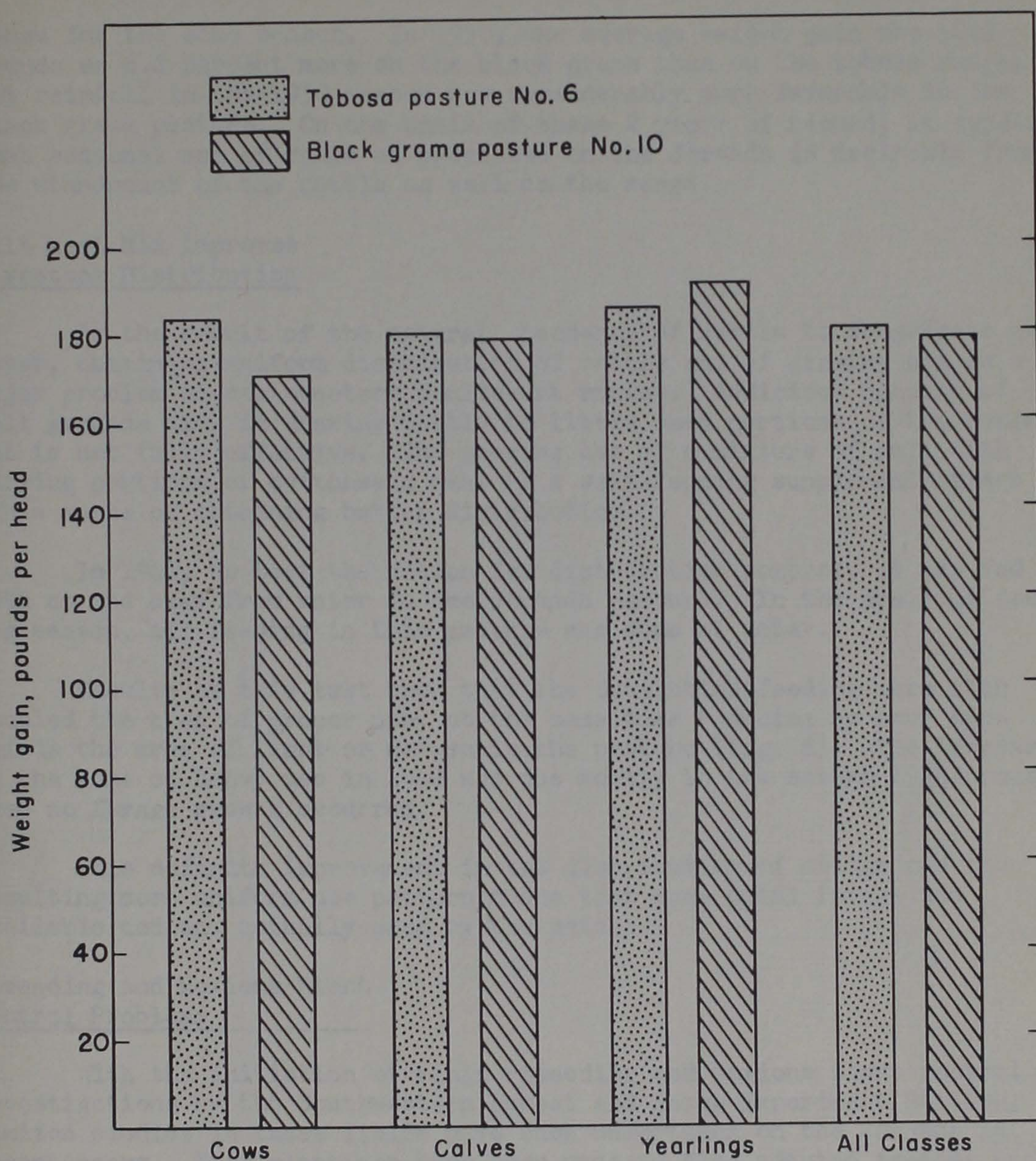


Figure 7. Weight gains of three classes of livestock on tobosa and black grama pastures, Jornada Experimental Range, Summer-fall grazing season, from mid-July to early November 1949 and 1950.

range for the same season. In 1950, the average weight gain was 12.2 pounds or 6.2 percent more on the black grama than on the tobosa range, but rainfall in the 1950 season was considerably more favorable in the black grama pasture. On the basis of these 2 years of record, it appears that seasonal use of range as practiced on the Jornada is desirable from the standpoint of the cattle as well as the range.

Salt-meal Mix Improves Livestock Distribution

As the result of the natural tendency of cattle to congregate near water, obtaining uniform distribution of cattle and of grazing use is a major problem on southwestern semidesert ranges. Judicious placing of salt grounds aids in drawing cattle to little used portions of the range, but is not fully effective. The growing use of a mixture of salt with varying portions of cottonseed meal as a self-feeding supplement offers a new means of obtaining better distribution.

In 1949, to test the ration for distribution control, it was fed both at and away from water in one Jornada pasture. In the previous feeding season, all feeding in this pasture was done at water.

Results of this test show that the outstation feeding more than doubled the area of proper use, at the same time reducing by over two-thirds the area of light or no use in the pasture (Fig. 8). The increase in the zone of heavy use in 1949 was due mostly to the severe 1948 drought when no forage growth occurred.

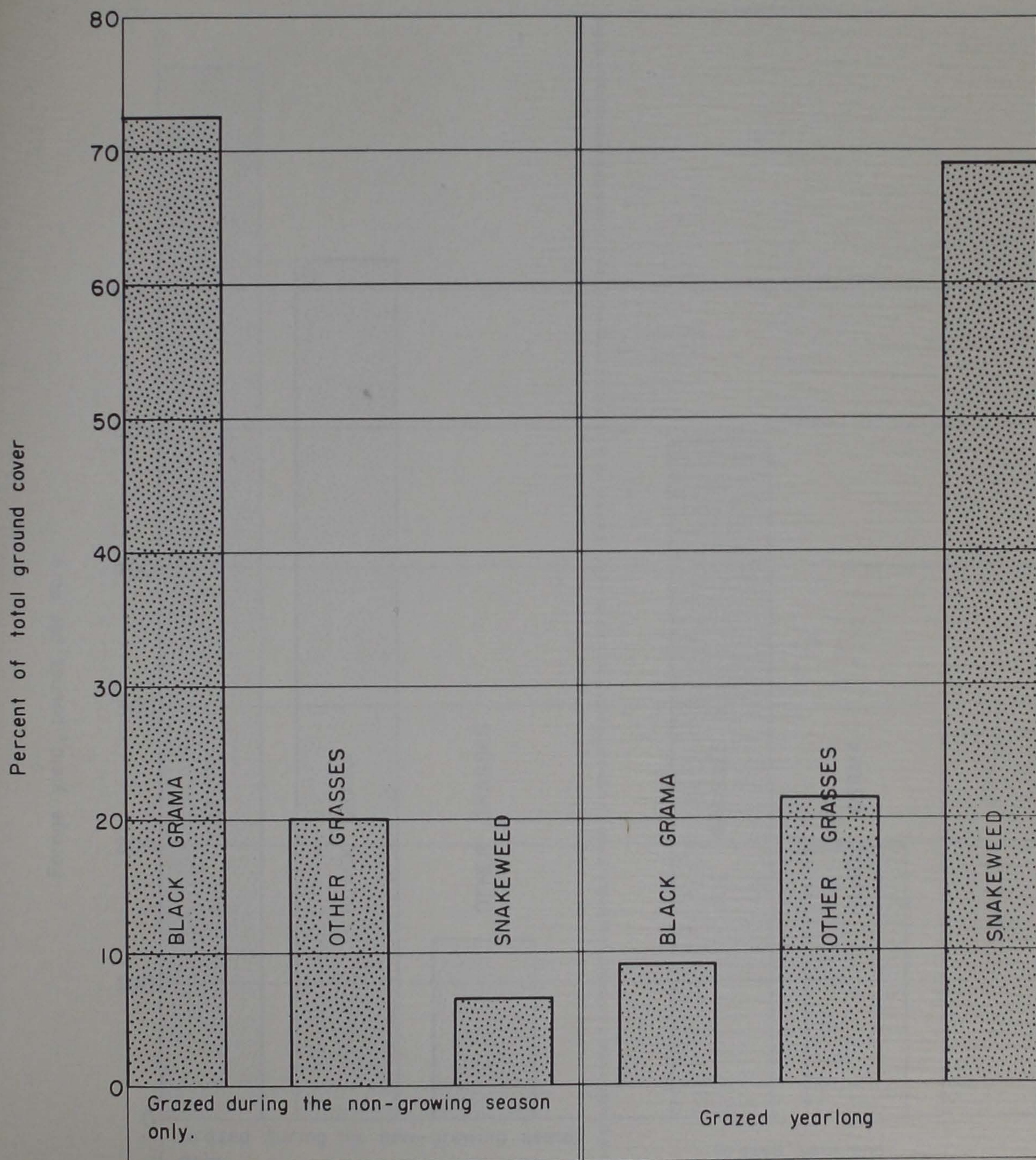
This definite improvement in the distribution of cattle and the resulting more uniform use pattern means that more total forage was available and was actually used by the cattle.

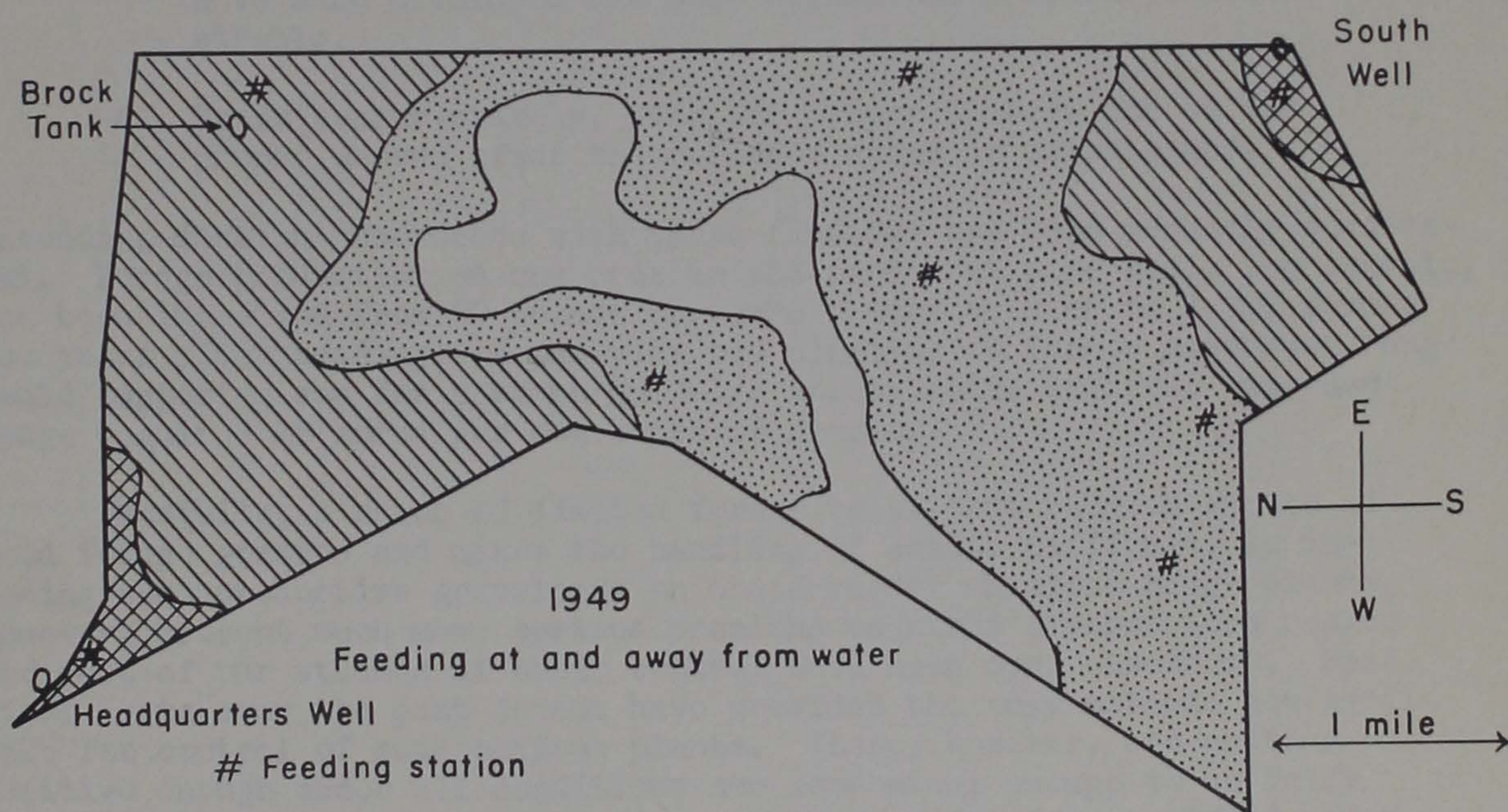
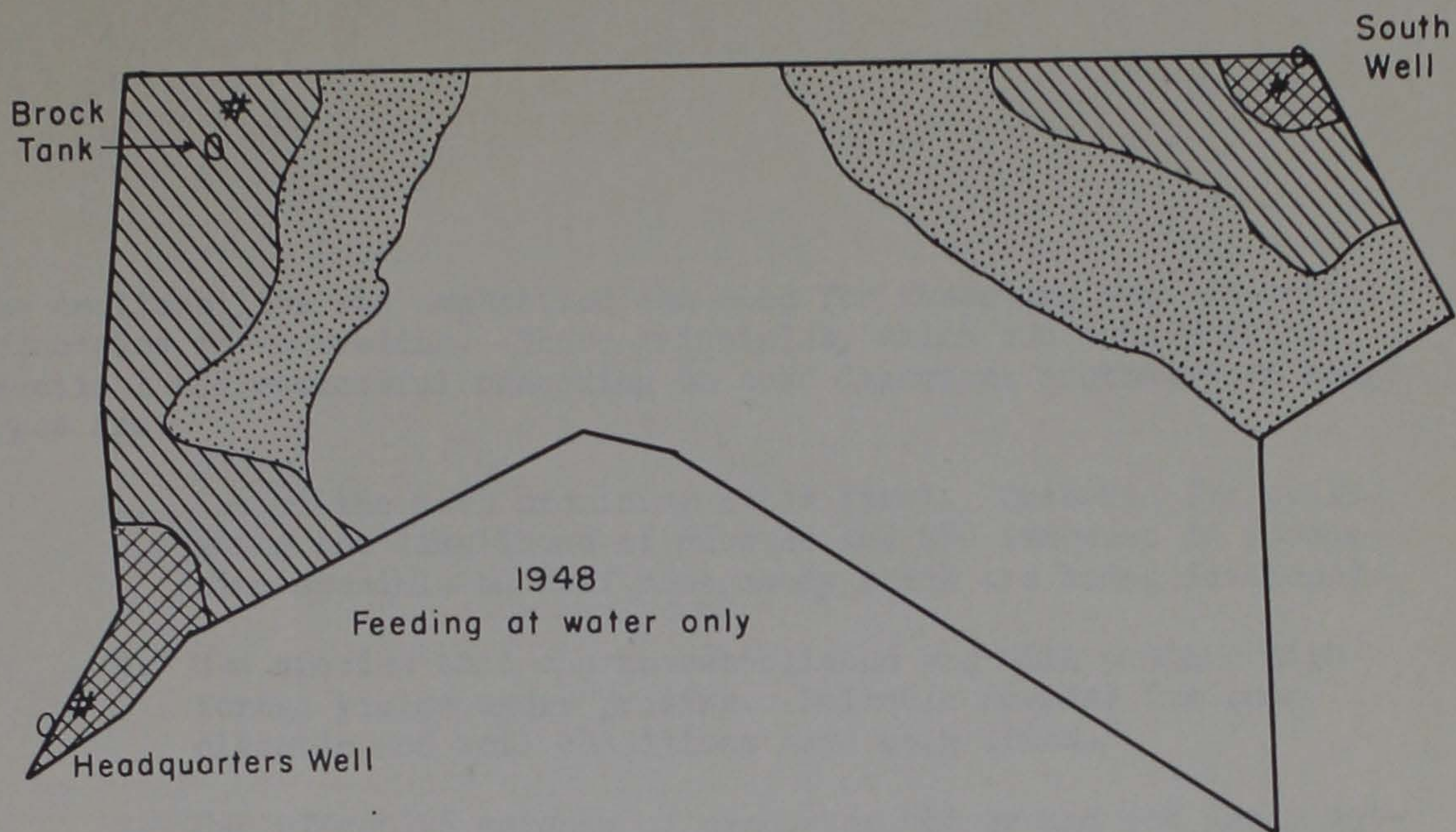
Reseeding and Noxious Plant Control Problems

With the initiation of range reseeding and noxious plant control investigations by the Southwestern Forest and Range Experiment Station, limited studies in these fields have been undertaken on the Jornada in recent years. Test plantings have been made to find adapted species and effective and economical methods for reseeding deteriorated semidesert grasslands, and restoring their productiveness. The value of oils, arsenicals, plant growth regulators and other herbicides for killing sand dune mesquite has also been tested empirically. It has not been possible, however, to give these important problems the study they deserve.

The Jornada has served as a base of operation for reseeding studies on more favorable sites in other parts of New Mexico. These have proven

Figure 5. Vegetational composition of black grama range
grazed yearlong, and during the non-growing season only.





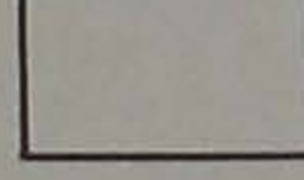
Degree of use	Area so used in 1948	Area so used in 1949
 Excessive	3.6%	4.6%
 Heavy	17.1	36.5
 Proper	22.7	46.7
 Light	54.6	12.2

Figure 8. FORAGE UTILIZATION IN RELATION TO LOCATION OF FEEDING STATIONS
JORNADA PASTURE 10

the applicability and emphasized the need for observing some essential principles for reseeding. These principles, which can make possible practical and successful reseeding on some important Southwestern range types are:

1. Reseed the most promising sites first. Criteria for evaluating the likelihood of success and the increase in production possible on different needy areas are being developed.
2. Use species that can be established and will produce high forage yields under grazing. Suitable species for some climatic and soil conditions have been found.
3. Use effective methods of preparing the ground and for planting seed at the proper depth, rate, and season. Such methods have been developed but more economical procedures are desirable.
4. Graze conservatively, with the proper numbers and at the proper season after the reseeded stand is established.

Reseeding done in accordance with these findings has been markedly successful. Forage production on one area in the ponderosa pine zone, for example, has been increased from 80 pounds per acre before seeding to 2,500 pounds two years after seeding. A one-year-old planting on former sagebrush range could support a cow for a month on 2-1/2 acres, while adjacent unseeded range requires 25 acres per cow month of grazing.

Mesquite, a shrub of limited forage value that reduces growth of good forage grasses and makes the handling of cattle difficult, is invading some productive grasslands on the Jornada. Noxious range plants, however, present much more serious problems on other southwestern ranges and most of our studies of their control have been done elsewhere. Practical tests over the past decade have provided the only methods now available for control of some noxious plants. These, however, are neither positive enough under all conditions nor economical enough to be fully satisfactory. Last year the studies were expanded and intensified under the Research and Marketing Act. These new fundamental studies, which so far have been confined to Arizona, should lead to more effective control methods throughout the Southwest.

Tucson, Arizona
October 1948
Revised April 1951